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Subcutaneous emphysema, spontaneous pneumo thorax, and pneumo mediastinum in COVID 19 Rare but Bothersome complications

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Abstract

Background: Coronavirus disease is an infectious disease caused by SARS-CoV-2. The patient presents with clinical symptoms of dry cough, fever, fatigue, dyspnea, loss of smell, and diarrhea. It may progress to severe pneumonia and ARDS with a high mortality rate. We present a case series comprising three cases suffering from COVID-19, showing the development of spontaneous pneumo mediastinum, pneumo thorax, and subcutaneous emphysema or either of these with/ without positive pressure ventilation. The complications of pneumo mediastinum and pneumo thorax in patients of covid 19 is very rare and present a dismal prognosis.

Case presentation: A 22 yr old male patient presented to the emergency department with complaints of cough, fever for 4 days, and shortness of breath for one day. A 45-year-old diabetic female having COVID-19, home isolated for 5 days, developed severe breathlessness and palpitations for the last one day. She was admitted to COVID ICU, intubated and mechanically ventilated with volume control ventilation (VCV) mode, FiO2: 50%, respiratory rate 24/min, Tidal volume 400ml, PEEP 10cm H2O. A 38 yr old female presented with a history of dry cough, and fever for 3 days. After detailed examination, pulse oximetry reported 85% oxygen saturation, temperature 101 degrees F, rest examination being insignificant.

Conclusions: A susceptible trachea in combination with altered immune status, emergency intubation, frequent pruning, and high positive end-expiratory pressure (PEEP) can lead to an increase in the occurrence of pneumo mediastinum and subcutaneous emphysema. Follow-up CT post-admission especially in a refractory case can prove to be a boon for the patient.

Keywords: Covid-19, pneumo mediastinum, pneumo thorax, emphysema

Introduction

Coronavirus disease is an infectious disease caused by severe acute respiratory syndrome virus coronavirus 2 (SARS-CoV-2). The disease was first seen in December 2019 in Wuhan and has been spreading globally, resulting in a global pandemic.[1] The patient presents with clinical symptoms of dry cough, fever, fatigue, dyspnea, loss of smell, and diarrhea. It may progress to severe pneumonia and acute respiratory distress syndrome (ARDS) with a high mortality rate. Since the onset of the

pandemic, there has been an increase in reports of cases with mediastinal air and sub-cutaneous emphysema with/without associated pneumo thorax. Though mechanical ventilation has been implicated as the major concern leading to barotrauma and subsequently these complications, but there have been cases reported and studies done that indicate these complications are seen even in non-intubated covid positive patients. Thus the need to look for alternative aetiology.

We hereby present a case series comprising three cases suffering from COVID-19 and showing the development of spontaneous pneumo mediastinum, pneumo thorax, and subcutaneous emphysema or either of these with/ without positive pressure ventilation. A 22 yr old male patient presented to the emergency department with complaints of cough, fever for 4 days, and shortness of breath for one day. A 45-year-old diabetic female having COVID-19, home isolated for 5 days, developed severe breathlessness and palpitations for the last one day. A 38 yr old female presented with a history of dry cough, and fever for 3 days.

The complications of pneumo mediastinum and pneumo thorax in patients of covid 19 present a dismal prognosis. The vulnerable immune system, compromised lungs along with long wee hours of working of healthcare workers with fear of getting caught in the middle of the pandemic are the factors that contribute to the development of pneumo mediastinum and pneumo thorax. Regular CT follow-up is a must to prevent such complications.

Case presentation

Case 1

A 22 yr. old male patient presented to the emergency department with complaints of cough, fever for 4 days, and shortness of breath for one day. On presentation his SpO2 was 80% on room air with a respiratory rate of 30/ min, pulse 110/ min, BP 120/ 70mm Hg, and temperature of 1degreesree F. Patient were taken on the nonrebreathing mask with a flow of 15L/ min. With this, SpO2 improved to 92% arespiratoryory rate to 24/ min.

A nasopharyngeal swab sent for COVID-19 was positive and the patient was transferred to COVID ICU. His chest X-ray (CXR) showed bilateral basilar airspace opacities. His work of breathing and oxygen requirement progressively increased. ABG showed PaO2 of 56mm Hg, PCO2 84mm Hg, pH 7.22, and HCO3 34meq/L. The patient was put on noninvasive ventilation (NIV) with FiO2 of 1.0, Ps 14cm of H2O, Peep 8cm of H2O on which, a saturation of 92%-94% was maintained till day 7 when he developed anxiety, extensive subcutaneous emphysema extending from neck to chest and SpO2 dropped to 90%. A CXR revealed left side pneumo thorax and pneumo mediastinum treated with chest tube thoracostomy with resolution. He was gradually weaned off noninvasive ventilation over 3 days. The Intercoastal drainage tube was successfully removed on day 14 and the patient was discharged on day 18 with SpO2 of 95% on air.

Case 2

A 45-year-old diabetic female having COVID-19, home isolated for 5 days, developed severe breathlessness and palpitations for the last one day. The patient received SpO2 of 50%, respiratory rate 50/min. She was admitted to COVID ICU, intubated and mechanically ventilated with volume control mode (VCV) mode, FiO2: 50%, respiratory rate 24/min, Tidal volume 400ml, PEEP 10cm H2O. Ceftriaxone, Azithromycin, methylprednisolone 40mg iv BD, insulin with vitamin C, and zinc were started. Chest X-ray showed bilateral diffuse airspace opacities. HRCT chest done on day 3 revealed widespread bilateral ground-glass opacities (GGO) with interlobular septal thickening with diffuse pneumo

mediastinum, right pneumo thorax, and diffuse subcutaneous emphysema in the neck and chest wall. Chest tube insertion in the right pleural space was done. The patient's condition continued to deteriorate. She eventually succumbed to the disease on day 6.

Case 3

A 38 yr. old female presented with a history of dry cough, and fever for 3 days. After detailed examination, pulse oximetry reported 85% oxygen saturation, temperature 101 degrees F, rest examination being insignificant. Oxygen was given to her with a non-rebreathing mask at 10L/min. The patient was diagnosed with COVID positive through RTPCR and was shifted to COVID ICU. Day 1 chest x-ray revealed left side basal consolidation. Patient condition stabilized, saturation improved to 94% on nasal prongs at 4L/min, and shifted to COVID ward after 4 days. She had an episode of severe breathlessness on day 7 with increased oxygen requirement in the ward. The patient was made prone and put on a non-rebreathing mask at 15L/min with which she maintained maximum saturation of 93%. X-ray chest was repeated and HRCT was done. It showed bilateral ground-glass opacities with pneumo mediastinum. The patient was treated conservatively with oxygen support via a nonrebreathing mask after the cardiovascular surgeon's opinion. She gradually improved requiring minimal oxygen support and was discharged from the hospital on day 15 with room air saturation of 96%.

Discussion

SARS -CoV 2 – an RNA virus that shares about 82% nucleotide sequence with human SARS CoV. The usual incubation period is 2-14 days and the most common symptoms reported are dry coughs, fever, malaise, sore throat, headache, and loss of taste and smell at later stages. Usually, the symptoms are mild but severe manifestations such as sepsis, pneumonia, ARDS and finally progressing to multiorgan failure have been reported. An immune response mediated by IL 6, leads to the release of IL- 1B leads to lung and alveolar damage, and finally leads to fibrosis of the lungs.[1,2] Radiologically it manifests as ground-glass opacities in later phases with predominantly peripheral distribution in lower lobes.

The presence of air between the pleural layers (visceral and parietal pleura) is pneumothorax. The presence of air tracking in the mediastinum is PM. These can be divided into traumatic, iatrogenic, or spontaneous. The most common iatrogenic cause is excess ventilation or alveolar damage secondary to diseases and rupture of bullae after ventilation. Spontaneous pneumo mediastinum is the most common. Common causes of secondary PM (SPM) that occur due to previous lung disease like asthma, alveolar damage due to pneumonia, etc.[2,3] Cytokine storm associated with covid 19 causes destruction of alveoli and traveling of air along broncho vascular sheath, known as Mackelins phenomenon. The alveolar air travels centripetally dissecting along broncho vascular membranes through pulmonary interstitium towards the hila, leading to development of pneumo mediastinum, pneumotho rax and pneumo pericardium.[6,7]

Due to cytokine storm, Covid is associated with alveolar edema and airway damage thus leading to weakening of the membranous tracheal wall, making it vulnerable to injury during intubation or positioning maneuvers as reported by Wali et al in their case series.[5]

The covid pandemic has drained the health care workers both mentally and physically. The deterioration of patients' health as well as exhaustion of health care services due to overwhelming patient load, leading to expeditious efforts at intubation, especially in emergent hypoxemia is also a contributing factor that may lead to more chances of tracheal injury and consequent pneumotho rax and pneumo mediastinum.[5]

CT scan is the diagnostic modality of choice. The presence of sub cutaneous emphysema, pneumo pericardium, and pneumo thorax, typical features of ground glass opacification, broncho vascular thickening, and dilatation, airspace consolidation, and crazy paving appearance can be seen in CT scan of covid patients. Suspected tracheal injury can also be ruled out.[10,11]

More number of patients were put in a prone position due to its ventilation - perfusion benefits; frequent repositioning may have led to the trachea bronchial injury. There have been cases reported where prone positioning has led to the development of pneumo mediastinum.[4]

In a study conducted in 2020, in mechanically ventilated patients with ARDS were covid positive, the authors were of the view that pneumo mediastinum and subcutaneous emphysema were seven times more frequent, despite a prolonged ventilation strategy. They concluded that lung frailty in CoV- ARDS was more an explanation for this development rather than barotrauma which is due to high transpulmonary pressure.[10]

Several treatment modalities have been disclosed in the literature. We employ subcutaneous chest drain in our two patients with worsening hemodynamics and respiratory compromise. The drain was subsequently removed after no more air-water levels were seen and confirmed clinically and radiologically. Several other modalities include a conservative approach, needle aspiration, fenestrated subcutaneous catheter, and chest drain insertion.[4,11]

Conclusions

Though rare a finding pneumo mediastinum and sub cutaneous emphysema are poor prognostic markers in Covid 19 patients. The alveolar and airway edema along with increased lung frailty contribute to increased chances of alveolar rupture and air in the interstitium leading to pneumo thorax, pneumo mediastinum, and subcutaneous emphysema even without intubation or mechanical ventilation. Though the prognosis may not be different in these patients with or without these sequelae, these cases highlight the importance of careful early intervention. CT scan is the modality of choice for diagnosis. The treatment of choice is chest drain insertion. We emphasize the follow-up of surviving patients as they may be prone to pulmonary fibrosis, pneumomediastinum, pneumothorax, etc. later on. Lung function tests need to be evaluated as they may be prone to COPD in these patients in the long run.

Informed consent

A written informed consent was taken from participants or their attendant to publish this case, however their personal details about name, address shall not be disclosed but anonymity cannot be guaranteed.

List of abbreviations

SARS-CoV-2: severe acute respiratory syndrome virus coronavirus 2

COPD: Chronic obstructive pulmonary disease

ARDS: Acute respiratory distress syndrome

VCV: volume control ventilation

PEEP: Peak end expiratory pressure

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